

Department of Business, Energy and Industrial Strategy and Ofgem, Open Consultation on Proposals for a Future System Operator Role

Dear Sir/Madam,

We are pleased to submit the IET's response to the Open Consultation on Proposals for a Future System Operator Role.

The Institution of Engineering and Technology (IET) is Europe's largest professional engineering and technology organisation with 154,000 members drawn from industry, academia and the public sector. The members represent a wide range of expertise, from technical experts to business leaders, encompassing a wealth of professional experience and knowledge. Our primary aims are:

- to provide a global knowledge network, promoting the exchange of ideas between business, academia, governments and professional bodies, and enhancing the positive role of science, engineering and technology
- to address challenges that face society in the future.

We would be happy to discuss our response in more detail and provide examples and evidence from our earlier reports and extensive networks of engineering employers and academic partners.

Establishing the FSO in the way that we outline offers a once in a generation opportunity. It has the potential to significantly increase the likelihood of timely delivery of Net Zero and with best value.

Recommendations:

Our principal recommendations are summarised in the box below.

The proposed FSO has the potential to be a highly effective element in Britain's energy transition, provided the following Critical Success Factors are addressed:

1. **True whole-system capability** must be in the FSO's remit, extending to local communities, smart homes, the grid edge and, in due course to cross-vector energy interactions.
2. **Early enablement by BEIS and Ofgem** is key to the FSO being able to establish new roles and respond to the pace of technology change and the needs of market participants.
3. The **FSO organisation** requires clean-sheet design to ensure management focus on the diverse areas of critical real time system operation, and new and complex strategic/advisory responsibilities.
4. **The ownership of the FSO** should guarantee absolute impartiality in its operation and a focus on best value engineering/market outcomes.
5. **The complex relationships** with other actors must be set on a path that is crystal clear, with a particular emphasis in the near-term on the integration of ESO and DSO functions.
6. In tandem with the Energy Code Reform consultation, it is an imperative **that agile governance and change processes** are established; arrangements resembling those of today will undermine the capability for the FSO to deliver its intended benefits.

The IET welcomes this and other recent papers and consultation documents which together constitute important steps in realising an energy system able to deliver the Government's Net Zero commitments in ways that add best value for consumers. We are encouraged that the work has absorbed to a considerable degree, the ground-breaking findings we published in 2012¹, and the various stages of the Future Power Systems Architecture programme we undertook in partnership with the Energy Systems Catapult.² The IET also provided peer challenge to the Engineering Standards Review panel.³

Preface

We have responded to individual questions but would draw particular attention to the following issues, expanding on the points in the summary box above.

The FSO's Remit

We are pleased to see the **whole system emphasis** in the document, and it is vital that this is at the heart of how the FSO role evolves. However, a number of important areas are not addressed explicitly, for example solutions around the grid edge and in consumers' hands, community, city and other smaller scale energy solutions, the importance of digitalisation and AI, and the contribution energy decisions can make to wider social outcomes around for example: mobility, health and vulnerable customers.

We would recommend that **legislation is drafted sufficiently widely** to allow these important areas to be embraced appropriately by the FSO as consensus emerges in these areas. We also strongly support the governance and legislative model taking account of the potential need to encompass a more multi-vector definition of 'system operation' in the future – for example, if hydrogen emerges as systemically important in managing our national energy balance, agile governance and rigorous technical co-ordination will be necessary between systems to ensure operational stability and security in near real-time.

Urgency

We believe there is **genuine urgency** to establish the FSO so that it can positively impact the strategic aspects of delivering Net Zero. We are concerned that the likely timescale for legislation will cause harmful delay. The FSO will bring new value only once it extends the current ESO's remit to include more effective strategic planning, management, and greater technical and market coordination across the energy system. It would be highly desirable to get started early in a shadow mode, but for this to be more than simply a re-branding of the current ESO.

Organisational Design

The functionality and duties of the FSO are relatively straightforward to establish; much harder is to ensure the FSO is set fair for a successful future, for example its skills, culture, openness to new thinking and entirely fresh innovation will need to reflect its distinctly differing roles to those of the current ESO. It would be a mistake when considering 'organisational design' not to start with **a fresh sheet of paper** – ensuring that the overall framework is set to achieve focus and balance across

¹ See IET Handling a Shock to the System report: <https://www.theiet.org/impact-society/factfiles/energy-factfiles/energy-generation-and-policy/electricity-networks-technical-statement/>

² See FPSA reports including: <https://www.theiet.org/media/2300/fpsa-summary-report.pdf> and <https://www.theiet.org/impact-society/sectors/energy/energy-news/2019-news/fpsa3-fast-track-to-britain-s-future-power-system/>

³ BEIS/Ofgem Engineering Standards Review: <https://www.gov.uk/government/publications/electrical-engineering-standards-independent-review>

functions current and new, with suitable managerial separation between system operation, technical coordination, and strategic advice. Such organisational design should, from the outset, address skill sets and management structures from Board level downwards. Specifically, we believe there are some pressing coordination issues between sector parties which will act as a brake on investment needed to achieve the national Net Zero ambition unless they are examined urgently. Creating the capacity of the institution to perform its advisory function and contribute evidence to assist in the deliverability of Net Zero should be an early priority.

The advisory role is a welcome proposal, but from all perspectives must be impartial and at arm's length from political influence. This poses challenges for both public and private sector ownership models. Helpful structural examples might include Ofgem itself.

Technical coordination is mentioned, but it is important that this coordination role encompasses both engineering and relevant aspects of market design, operation, evolution, and facilitating of innovation.

Various important matters are not referenced explicitly. Whilst there is acknowledgement of the importance of the relationship with DSOs, there is a wider agenda which needs to be considered around IDSOs, community energy enterprises, wider developments in cities and local authorities, and wider considerations of "place". We believe there is a set of issues to be explored about where strategic decision-making on place-based issues needs to sit between the new FSO, and future DSO functions.

Ownership, Leadership and Culture

The ownership of the FSO should guarantee absolute impartiality in its operation and a focus on best value engineering/market outcomes.

We also feel an important parameter may have been overlooked which is that of **leadership and culture**. It is vital that a future system operator can take a genuinely whole-system view. This does not mean only looking across the different energy vectors, and understanding how transmission and distribution networks work together, but also the full extent of the roles of grid edge solutions, local solutions, system-wide digitalisation, cross sector collaboration / stakeholder engagement, and the key interfaces between energy and other systems in society. To do this will require a special kind of leadership, quite different to established patterns. We understand the reason to build the FSO out of the existing transmission organisations, but in doing so **it will be key to success that the new organisation is equipped to think differently** – the task is in many ways quite different. This should be reflected in the remit, Board membership, leadership, incentives and organisational arrangements of the FSO. As noted earlier, it will be important that the FSO's structure creates separate and balanced focus for its distinctly differing roles, notably system operation, differing from whole system technical coordination, differing again from strategic planning and advice.

Relationships and Coordination

A fundamentally important area that is glossed over is **the need for coordination – if not integration – of ESO and DSO functions** so that the electricity system can be operated efficiently as an integrated whole. The continuous transformation of the electricity distribution system from a largely passive system to an actively managed system (applying Advanced Distribution Management Systems (ADMS) and active management of DERS (DERMS)) requires a whole (electricity) system approach. An example

is referenced here⁴. This approach also facilitates coordination in deployment of flexibility where grid-edge technologies are already playing a key role –and which in future will be increasingly important – for example in smart EV charging and both supply and demand-side cross-vector arbitrage. Significant investment will be needed in integrating IT systems and ensuring data interoperability.

Authority and Responsibilities

The document does not seem clear about what **authority** the FSO should have; in the case of technical coordination an advisory role is not sufficient, as was demonstrated by the inquiry into a major US shutdown⁵. Greater clarity is needed as to what the FSO is to be held accountable for – ie in what areas must it have authority to act, noting that this need for authority should be only a backstop provision, used in the absence of working by consensus across industry parties.

Similarly, ensuring **compliance with codes and standards** isn't mentioned. This is an issue today, particularly where new technologies and/or market solutions to maintaining compliance are introduced. For example, the NGE SO NOA High Voltage Pathfinder is taking network compliance from the TO and placing it either on the ESO or the service provider. A further example is the competitive procurement of frequency response services such as Dynamic Containment in lieu of mandatory provision. Does the FSO become responsible for maintaining and checking compliance to the SQSS operational and planning standards which is a substantive and complex topic area? Assuming that the FSO is not held accountable for the operational performance of specific assets, it will be important that it has adequate technical resource in place to undertake a compliance assurance role. However, this could duplicate existing resources in other bodies, which would not be in consumers' best interests. Moreover, in terms of compliance, it is an imperative **that agile governance and change processes** are established; arrangements resembling those of today will undermine the capability for the FSO to deliver its intended benefits.

Next Steps

Establishing the FSO in the way that we outline offers a once in a generation opportunity. It has the potential to significantly increase the likelihood of timely delivery of Net Zero and with best value.

The IET would welcome the opportunity to help government navigate the pitfalls associated with complex change, working with other parties in a spirit of cooperation.

⁴ The Power Potential NIC project where (UKPN) Distribution Control and ESO control centres communicate in real time through an ICCP link to optimise the system in SE England is an example of integration of T/D functionality. See <https://www.nationalgrideso.com/future-energy/projects/power-potential>

⁵ Reference Page 21 at <https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf> The lessons from the big US shutdown in 2003 included criticism of institutional arrangements stating "[there was a lack of] authority to develop strong reliability standards and to enforce compliance with those standards"

Responses to the Consultation Questions

1. Do you agree that Net Zero will create the need for new technical roles in the electricity and gas systems, and require a new approach to energy system governance?

Yes. The IET has been putting forward and refining this case now in electricity for almost a decade (See earlier Footnotes 1,2). Not changing to create new technical roles will result in a fragmented approach that will fail to take advantage of many of the new opportunities. It would risk prioritising short term fixes, cost vastly more and probably fall short of the target. An example would be the emergence of new business models in the flexibility market, where the power of digital technology enables new business models and will bring different players into the energy system as we know it today. The same arguments apply across the energy system and into wider systems in society.

2. Do you agree that the establishment of a Future System Operator is needed to fulfil the kinds of technical roles needed to drive Net Zero?

We believe this is one solution, and probably the best available given the current industry landscape. However, it is not without risks, notably in achieving a shift away from transmission-centricity to a genuinely whole system perspective embracing the grid edge, cities, wider systems in society such as mobility, health, housing, energy networks, energy production, storage and use at all scales, and the roles and perspectives of a very diverse group of organisations and people involved in all these.

We assume that “FSO” is simply a working title for the new organisation; clearly ‘Future’ will not always apply, but more importantly the organisation will have a wider role than that of System Operator. A self-explanatory alternative title could be “System Architect & Operator, SAO”. The concept of a system architect, a term used widely in other sectors, is explained in this IET report (Section 1.3)⁶

3. Do you agree that a Future System Operator should have roles in both the electricity and gas systems?

Yes. It is key that the energy system is conceived as a whole and with a perspective on other interconnected systems as well. As of today, this means primarily electricity and natural gas, but as described in the consultation document this should embrace new systems in strategic thinking, deployment and use, for example: hydrogen, district heating and the production, transport and secure disposal of carbon dioxide.

4. Do you agree that a Future System Operator should be entirely separate from National Grid plc?

In principle the IET is agnostic regarding who should own the FSO. What matters is its remit, functionality, capability, culture, incentivisation and ability to enjoy the trust of the whole industry (government, multiple regulators, incumbents and new entrants). In practice this may mean separation from National Grid plc is a necessary enabler, but we would be open to any solutions that delivered the required performance. A factor for consideration is to minimise conflicting incentives for the FSO; in today’s arrangement there is a friction between the ESO’s licence and the need to return value to shareholders. The current incentive arrangements offer little reward for the risk being carried.

⁶ <https://www.theiet.org/media/1249/pnjv-report-full.pdf>

5. What issues are there with existing institutional arrangements in the UK energy system in relation to system-wide decision-making and planning?

This is explored extensively in our previous work (references 1,2). In summary:

- The issues are many and varied but arise from institutional and licence remits that create silo-based decision making in Government departments, regulators, and organisations active in the industry,
- A mental model of the system, ingrained across many parties, that does not yet fully embrace its changing facets and systemic interconnections,
- Change processes that lack flexibility, agility and accessibility other than to industry incumbents, and
- A lack of mutual recognition and understanding of the impact of energy decisions on other systems in society and vice versa.

The arrangements described above have been convenient and effective for running the energy system in a period that has required only incremental development (as was broadly the case from the end of WW2 until around 2010), but they can no longer deliver effectively in the face of paradigm changes necessary to deliver Net Zero and respond to other societal, technical, and economic challenges.

We see three areas where the existing arrangements are particularly challenged:

- 1) **Conflicting incentives** – no individual policy or regulatory action, or market mechanism, exists in isolation. For example, the process of managing CfD auctions competitively has succeeded in driving down price but, in some respects mitigates against efficient coordination. There is an opportunity for the FSO to pro-actively assist in anticipating systemic implementation issues rather than just dealing with them reactively.
- 2) **Lack of pace and agility** – technology, the energy mix, and pressures from market parties are developing so rapidly that an inability to manage emergent issues effectively and in a timely way (such as the rise of behind the meter generation) could present real risks to security of supply, lock in unnecessary cost, deter innovation and compromise achievement of national Net Zero objectives.
- 3) **Bringing the right skills to bear** – much of our energy system transition to date has proceeded on an assumption that a technical solution could be found if market incentives are strong enough. To date this has largely been true. However, this misses the fact that with a much more digitally enabled, power-electronic enabled grid, we need to be making sure that the physical energy system we are building is fit for purpose in a set of conditions different to anything we have seen before. The right skills mix is essential to address much greater complexity in operation and planning, and new hazards associated with unintended outcomes resulting from interactions between intelligent controls within and between systems.

6. What examples/case studies are you aware of where Net Zero delivery in one part of the energy system did not adequately account for cross-system impacts or costs?

Five diverse areas are worthy of mention.

- 1) **Offshore infrastructure coordination** – we are moving to a situation where the seabed (especially in the North Sea) and landing points, are a finite resource and need to be managed

holistically. This has been explored recently by The IET⁷, working with multiple stakeholders who currently have little interaction or mutual understanding of respective roles and responsibilities. The report identifies “dispersed and uncoordinated development” as one of the key issues.

- 2) **EV charging** – currently EV charging investment is going to locations where there is the greatest likely payback, rather than taking a national perspective as to what density of charging network is needed and what this means for the wider energy system. This is a risk identified by the EV Energy Task Force which has highlighted the need for effective planning and coordination of infrastructure.⁸
- 3) **Hydrogen and City scale transition** – The IET believe it is very likely that if we move to hydrogen for heat this will be implemented regionally, because of the need to create and scale clusters with a cost-effective balance of supply and demand. This is one of many areas where regional/city level actors are ambitious to act, but our national approach to energy system management and regulation is a barrier to them being able to do so. The IET has examined a number of aspects of transitioning to hydrogen⁹. This report concludes “it is vital that the development of hydrogen and CCuS infrastructure are coordinated” and it is self-evident that this coordination will need to extend to the electricity system, both as regards the electrical demand for hydrogen electrolyzers and the potential for hydrogen to provide bulk energy storage.
- 4) **Long-duration energy storage** - we are currently lacking in a strategy for inter-seasonal and other forms of long-duration energy storage. The effects of climate change may well lead to changes in the Jet Stream leading to weather-blocking events (potentially several days where low wind conditions prevail). If the Gulf Stream continues to weaken, we are likely to experience much colder winters leading to higher electricity heating demand during winter, leaving us further exposed to supply margin risk and price spikes. There are several technologies showing potential, including hydrogen, compressed air and batteries, and each have new stakeholder interfaces and the potential for cross-vector interaction. The markets should provide strong incentives for development. However, under present arrangements, they will not drive technical coordination, integration of automation, or locational placement for best impact.
- 5) **Flexibility** - is probably the biggest system operational challenge for the next decade and a core justification for making structural changes to the industry. This is inherently a whole system imperative, and must extend cross-vector in terms of flexibility derived from supply and demand-side arbitrage. Ensuring optimum application of full-chain flexibility through an integrated liquid market will be key. What we have currently is a siloed approach where different parties are chasing flexibility for their own specific needs without any real consideration of synergies, conflicts, or whether it might be of greater value serving a different aspect of system operation. This is a key issue and we recommend it is addressed more explicitly in the proposals.

⁷ IET North Sea report, see page 37: <https://www.theiet.org/media/7787/offshore-energy-infrastructure-landscaping-report.pdf>

⁸ <https://evenergytaskforce.com/reports/work-package-one/>

⁹ <https://www.theiet.org/impact-society/factfiles/energy-factfiles/energy-generation-and-policy/transitioning-to-hydrogen/>

7. Where should government focus in our efforts to improve systems thinking and coordination across the energy system?

The proposals set out in this and related policy papers from July 20th 2021 set out a broad set of important issues to be addressed, all of which have the potential to help improve systems thinking and coordination. Other important issues that appear underplayed in the consultation documents include:

- Setting the system up to enable **grid edge innovation** to realise its full potential, not only in terms of consumer experience but in forming a fully integrated part of energy system operation
- Ensuring the **FSO design** has the right leadership, culture and organisational structure for success
- Enabling **city and other community scale energy systems** to flourish, and establishing frameworks to find the right balance between decision making and implementation at national and local scales.
- Ensuring effort is focussed on the **core strategic questions** which require decisions that could lead to large-scale investment requirements, for example in decarbonisation of heating, the right strategic mix of blue and green H₂, and the prioritisation of EV charging infrastructure.
- Ensuring that the FSO plays its part in **wider Net Zero decision making**, is fully embracing of the connections between **energy and other systems**, including ESO and DSOs, and is directed to act in a way consistent with cost-effective delivery of Net Zero overall, not just in energy
- Underpinning a number of the above points is **the issue of 'boundaries'**, often determined in legislation; for example, the regulated companies (and indeed Ofgem) have tended to see their responsibilities 'stop at the meter'. Examples of this can be found in earlier Ofgem and industry documents that describe 'whole systems' as "Transmission + Distribution" which is clearly an inadequate perspective in the emerging world of active customers and grid-edge technologies such as EV smart charging.

8. Do you agree that the FSO should undertake all the existing roles and functions of NGESO? If not, please explain why.

For us there is room for discussion as to whether the day-to-day operations functions of NGESO should belong to the proposed FSO, or whether its remit should be more strategic, as has been proposed for the gas part of the energy system. Keeping the day-to-day operations functions in scope would in some ways enhance credibility, influence and certainly deep engineering knowledge – Ministers would have to listen to the people who keep the lights on. However, it also runs the risk of a cultural predisposition to "big system" solutions, and distract the focus from good strategic thinking towards day to day matters, especially given that system operation is already becoming more challenging. Day to day operations and strategic functions need to be kept apart or nothing will change. There are related questions as to the right Board membership to best govern these two quite different activities, both of which are vital.

9. Do you agree there is a case for the FSO to undertake the long-term strategic functions outlined in Option 1? Please elaborate and provide any views on the functions we have outlined in Option 1.

We agree, the gas system strategic functions in Option 1 would be appropriate for the FSO to undertake. The gas network is currently a significant provider of flexibility and energy storage for the

electricity system and the interaction between the two is systemically important. The decisions which will arise in coming years about whether and how to convert the gas network to hydrogen are also very significant, and this exercise would be a major national infrastructure programme which requires the right technical expertise and leadership – outwith the existing day to day operation of the gas grid. We are of the view that the issue is not so much about who undertakes certain roles, but more about relationships, authority, and the ability to share data.

10. Do you agree that there is not currently a case for the FSO to undertake all GSO roles and functions, including real-time gas system operation, as outlined in Option 2? If you do not agree please explain why.

Please see our comments on the equivalent question for electricity in Q8.

It is our understanding, that in a previous NG organisational arrangement gas operation was split out from the network function and brought under one SO. This didn't work because NG couldn't share data across license boundaries. When the ESO was legally separated, gas operation was integrated back with the transmission function. Because there is less complexity, less competition etc there isn't a strong case for separating it which is why we understand it is not included as a FSO function.

11. Do you have views on the proposal for an advisory role? What organisations do you consider would benefit from the provision of advice by the FSO? Who should bear the costs of providing that advice?

There are many parties that require unbiased, authoritative, accessible technical and industry advice and the concentration of this capability into the FSO may well give central government departments, regulators, city authorities and others a level of ready access to quality advice they do not currently enjoy. At the moment such advice tends to come from a range of sources, the Energy Systems Catapult being prominent, but also commercial consultancies, universities, research bodies, and the contribution of volunteers in professional bodies such as The IET.

There is a risk that the FSO, were it to become the sole source of advice, could lose the diversity of perspectives and impartiality the Government and other currently has access to. The FSO must be empowered to convey impartial technical advice and be free from political influence and correctness. It will be important for the FSO to be fully engaged with the wider expert community in sourcing and providing advice. The FSO should be equipped to reach out to respected sources of expertise and relevant stakeholders (which could include NIC, The IET, INCOSE, RAEng, Environment Agency). A diversity of perspectives will be critical – there have been perceptions in the past that the ESO defaults to 'traditional' engineering solutions rather than listening to more disruptive points of view. Also, much of the debate around Net Zero is framed in techno-economic terms, and we urgently need more practitioner engagement to help work out how to implement the physical changes needed to our national infrastructure. A model for consideration is National Grid's series of 'Pathfinder' projects¹⁰ which we believe should be perpetuated and expanded to wider areas of the energy system. However, our understanding is that the pathfinder projects were only possible once the ESO became separated from the TO. Compliance with SQSS standards is a TO responsibility and these projects are making it less clear who is responsible for network security. Engaging with more people isn't going to solve the

¹⁰ <https://www.nationalgrideso.com/future-energy/projects/pathfinders> We observe NOA Stability, Voltage Management and Constraint Management (also Distributed ReStart) as being good examples of wider engagement which counter the perceptions that ESO defaults to 'traditional' engineering solutions.

root cause of the problem, which is who is responsible for what, when something goes wrong or someone fails to deliver.

The benefits to consumers of developing a more flexible energy system through more strategic decision making are agreed to be very significant. We would argue that the cost of providing advice to help secure these benefits should not be a barrier to those who need it. Such advice should be user-friendly and timely. Given appropriate controls we would argue that it is in the long-term interest of consumers that decision makers are well-advised, and therefore for consumers to pay for the advice where affordability or access was otherwise a concern. Advice paid for by major industry players is likely to be perceived as biased even if it is offered objectively, and the FSO will need to be able to show it has not been put at risk of conflict of interest.

The above is all additional the FSO's core role, where it needs to have *accountability and authority* rather than provide advice.

12. Do you have any views on the other areas where we are considering new and enhanced roles and functions for the FSO (outlined in section 3.2)?

We view the areas set out as a reasonable start for drafting legislation, but a number of critical gaps can be identified. The missing functions could evolve, provided sufficient flexibility and authority is established from the outset for the FSO. We would identify in particular that:

- The FSO should have competence in and be accessible to **the developers of grid edge** and other digital technologies and business models, and be able to engage fully in realising their benefits
- The FSO should have competence in **local energy solutions** and their integration into wider societal systems and be accessible to local government and the private and third sectors, to be able to engage fully in realising benefits, and balancing local and national approaches
- However, there is some ambiguity in regard to how close the FSO needs to become to **local issues countrywide**. In our view the FSO needs to set principles and frameworks that enable local solutions (whether by DSOs or others), champion them, inform policy and provide advice, but not to attempt to micromanage them
- The provisions regarding **hydrogen, CCUS** and similar technologies must be flexible enough to accommodate other energy vectors not currently foreseen
- Given the pace of digital development, the legislation should be widely drafted to include **data and digital**, rather than the FSO being held back awaiting future changes
- The FSO should be obliged to coordinate an industry response to participating in relevant **engineering standards development outside the UK**, so the UK is able to influence these standards. This is something that is lacking currently
- The FSO maintains a perspective on **the future functionality of the energy system**, and drives work to implement required functions is taken forward¹¹
- Whilst we understand the reluctance to commit to FSO **roles in heat and transport** decarbonisation at this stage, given the pace of development we would encourage that the legislation allows for these to be added later without time consuming legislative processes
- An essential role that might be performed by the FSO is maintaining a comprehensive **whole energy system risk register** to identify and quantify emerging threats and opportunities (both probability and impact) along with effective mitigation measures. A particular focus would be

¹¹ See Ref 2

‘high impact low probability’ events. This would include cyber security risks, climate change (resilience of infrastructure) and potential human skills and material resource shortages.

- Identifying **priority areas for innovation across the full spectrum from TRL1 to TRL9**. This would include liaison with appropriate global industry and academic research organisations, identifying entrepreneurs, and recommending specific calls for innovation and appropriate funding mechanisms. Coordination of innovation to build on synergies would be key, as would identifying where promising innovation has progressed to a given TRL but stalled due to lack of resource.
- Playing a key role in **energy code governance** as an independent non-vested interest party with a long-term integrated whole energy system perspective. This will be essential in ensuring a progressive, cost-effective and agile system of energy code governance that is able to retain focus on whole energy system coordination and integration whilst responding quickly to emerging challenges (for example identified by the above-mentioned risk register) and opportunities such as the emergence of new technologies. An important consideration in the Design and Delivery of the Energy Code Reform consultation must be ensuring the FSO is able to initiate change and implement policy decisions, and not be impeded by a dysfunctional standards system.
- Bringing a **‘whole-energy systems engineering’** perspective to the continuously evolving architecture of the energy system to minimise the risk of suboptimal or stranded investments through a comprehensive understanding of interactions and interdependencies between elements of the whole energy system and of the relative benefits and risks of alternative pathways.

13. What are your views on our proposed characteristics and attributes of a future system operator and how the models presented would deliver against them? Are there other characteristics or attributes that we have not yet considered?

We have a concern that building the FSO out of teams that currently focus almost solely on transmission could result in a bias for large scale top-down approaches to problem solving, at just the time when many of the most promising opportunities and activities are at the grid edge. Hence, we suggest an attribute of “unbiased” which we see as different to “independent”. Achieving this would need careful consideration to leadership, incentives and culture. It is vital that a future system operator can take a genuinely whole-system view. This does not mean only looking across the different energy vectors, and understanding how transmission and distribution networks work together, but also the full extent of the roles of grid edge solutions, community solutions, system-wide digitalisation and the key interfaces between energy and other systems in society. To do this requires a special kind of leadership. We understand the reason to build the FSO out of the existing transmission organisations, but in doing so we recommend that the new organisation will need to be equipped to think quite differently if it is to succeed – its tasks for the future are in many ways quite different from today. This should be reflected in the remit, Board membership, leadership, incentives and organisational arrangements of the FSO.

14. Are we considering the right organisation models for the FSO? And why?

We are broadly agnostic as to organisation model, provided the desired attributes and functionality can be delivered in a genuinely whole system way. Our answer to Q8 raises a discussion point around whether day-to-day electricity system operation should be included. If it is, as proposed, we suggest measures are put in place from the outset to create separate organisational focus between system operational roles and the more strategic functions.

15. Are we considering the right elements for the FSO's regulatory and accountability frameworks? And why?

We would make suggestions as follows:

- The areas where the FSO has authority and accountability need to be stated clearly. In taking on the very necessary whole system coordination function, we would expect much to be decided by consensus, but the FSO will need backstop authority that can ensure essential action is taken or not taken. The future energy system will be increasingly complex with many interdependencies and potential risks to stability and security. Task groups, advisory panels and goodwill can be valuable: however, they should be viewed as necessary but not sufficient. See footnote 4 for salutary USA experience.
- The list of objectives for the FSO should be expanded to include the role of energy in achieving outcomes in society beyond the energy sector, to avoid a focus only on narrow energy matters and hence a lack of whole system perspective.
- Section 4.3.1 talks about the FSO keeping relevant energy sector developments under review, which we very much support. We would suggest this be clarified to mean “globally” – we need to the FSO to capture the best developments and learning elsewhere and digest it for GB application.
- The consultation document is currently silent on transformation delivery – who will design and lead the critical change initiatives needed to deliver the new strategic plans that are developed? This isn't addressed and also strategic plans cannot be developed without an understanding of transformation delivery mechanisms. In particular, the roles of BEIS and Ofgem in decision making should be made clear to ensure effective industry transformation.
- We would caution against an over-draconian economic regulatory regime for the FSO. The cost of the FSO will be a very small part of the energy sector, and the quality of its work critical to driving good strategic decisions and implementing the resulting strategies (as well as keeping the lights on). Clearly there needs to be value for money, but the mindset needs to be about deploying the right resources to get the right outcomes. The costs of many of these resources (people) are likely to be well in excess of normal Civil Service pay scales if the best are to be attracted, competing with the private sector and in the global market in many cases.

16. Do you have views on the level of shareholding or control involving other 'energy interests' and the FSO at which a conflict of interest would become a concern?

Although this is clearly an important matter we do not offer a specific view. In the case of board members we suggest that expertise will matter, which will need to be weighed against potential conflict of interest.

Arguably, the FSO should be a public entity if it is to provide a national strategic advisory role similar to the Infrastructure Commission or the CCC (but able to initiate, not just recommend).

We would note however, that exploration of the private sector ownership needs to carefully assess what investor expectations would be. The FSO as a standalone business could be perceived to hold a high degree of political/reputational risk, and the liability issues which might arise in the event of major operational mistakes or failures might be an area of investor concern. The private ownership model needs to not just explore the role of the profit motive, but also whether commercial liability/insurability considerations might constrain the FSO's freedom of action.

17. Are we considering the right implications of our proposals for Elexon and Xoserve?

Not answered.

18. What is your view on the preferred implementation approach? Please explain why.

The proposed arrangements look sensible in principle but are at risk of being very time consuming, and we note that no timeline is suggested in the implementation plan (Figure 1). Value will not be realised from the arrangements until the FSO is performing functions not currently performed by the ESO, which is all taking time from the 340 months that remain between when this is being drafted in September 2021 and when Net Zero has to be achieved. The transition period itself creates a risk of stasis, if decisions are delayed awaiting the new arrangements, and it seems likely that as much of 10% of the time until Net Zero must be achieved could be used up getting the arrangements fully in place.

Given that a key component of the new functionality is strategic in nature and does not pose a threat to live system operation, could this not be built up at pace within the ESO, with shadow leadership established, paid for through an adjustment in the ESO's regulatory settlement? Care would be needed to respect the legislative framework as set out in the Electricity Act 1989.

The cost of delay is potentially significant. It would increase the risk of poor decisions with high lock-in or exit costs, and the risk of delayed decisions leading to the need to implement later at high pace and therefore expensively. It also increases the risk that the already highly challenging task becomes too difficult to deliver on time, and the risk that UK export potential arising from early advantage is lost to overseas rivals.

Specifically – we believe there are big decisions about infrastructure rollout where the creation of the advisory function as early as possible, even in 'shadow' form, would allow that grouping to establish itself, start to build an evidence base, and actively inform the final operating model of the FSO itself.

19. Based on the areas where we are considering new and enhanced roles and functions for the FSO, which of these should be prioritised for development? Please explain why.

The most urgent priority is taking an authoritative strategic perspective on the key energy decisions to be taken over the next few years, taking care to approach these from a true whole system perspective. In principle the FSO could staff up quite quickly to be an intelligent buyer of this work from other reputable UK sources such as the Energy Systems Catapult, academia, the professional institutions or commercial consultancies. There is a role for training and upskilling that needs to be addressed if outside organisations are to carry out work. Expertise is still needed within the ESO to be an intelligent buyer and understand the work. Recruitment of power system engineers is challenging, but with better training and upskilling the pool could be increased.

20. What do you believe are the risks to implementation? How can these be mitigated?

The main risks would seem to be:

- **Time to achieve value**, where process complexities seem likely to risk this being lengthy. The FSO needs to hit the ground running, even if this means arranging to tool-up ahead of the changes being fully implemented.
- **Bias**: ensuring the implementation results in a true whole system capability and culture in the organisation, not an electricity and gas transmission culture

- **Agility:** the new organisation needs to be given a time window (and perhaps a specific target) to look at where existing regulation, codes and standards can be simplified, and made more outcome focused. Otherwise we risk ‘baking in’ existing ways of thinking and working.
- There is potentially a risk around the interaction with how detailed rules are made and implemented. For example, is the relationship with Ofgem or a proposed IRMB, an Integrated Rule Making Body?

21. Do you have any comments on potential implications of implementation for you, your organisation, or other stakeholders?

As a professional engineering institution there are no direct impacts for The IET. We do though have Members and Fellows across the industry, including in the current ESO. They do vital and highly skilled work, in many cases leading the work of keeping the lights on. The document paints a positive picture of their future and we would urge this to be realised, and appropriate action taken to reassure them and take them on the journey.

22. What is your view on the position there are likely to be cost savings across the energy system from an increased “whole system” view, as described in paragraphs 47-52 of the IA? If so, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?

We agree there will be savings of this type. More significantly perhaps will be savings arising from better strategic decision making, and better informed “fail fast” decisions during implementation. It takes courage to abandon ideas that have received significant investment but are found not to deliver benefits. However, the FSO will be well placed and qualified to do this.

23. What is your view on the conclusion that policy intervention is likely to increase the benefits of onshore electricity network competition, as described in paragraphs 53-59 of the IA? If you agree, is the potential magnitude of savings illustrated fairly in the IA? If not, why not?

We agree there could be marginal benefits through greater competition discovering lower cost ways of delivering network solutions, but agree that as identified these are relatively second order.

We also note that the regulatory landscape (taking account of issues within Ofgem’s purview as well, like transmission charging reform) is currently so complex that it risks driving perverse behaviour and incentives anyway. A competitive regime is more likely to bring value to consumers when the perceived policy and regulatory risk is lowered. In addition, we believe it is crucial that the full value of ‘non wires’ solutions and flexibility can be exploited, and any competitive landscape needs to incentivise efficiency overall.

We believe it is important not to lose sight of critical system operation functions in this. An increasingly competitive regime involving many players is likely to make system operation and planning even more complicated. This calls for increasing expertise in system operation sitting within the FSO, with the ability to anticipate and address emerging risks, ensure whole system perspectives and establish key engineering functionality such as data interoperability across market platforms and ownership boundaries.

24. Do you think that the impact assessment has identified and considered the key costs and benefits of policy intervention? If not, can you provide details on other impacts that have not been considered?

We have not examined the costs and benefits in detail and, while they seem credible, we would recommend further analysis. (see answer to Q22)

25. Do you think that the distribution of impacts is fairly represented, with impacted groups correctly identified? Outlined in table 5 of the IA.

Again, this seems credible. Presumably a further impact on National Grid plc would be a change in its corporate risk profile, were this to proceed.

26. We invite respondents' views on whether the proposals for energy system governance reform may have a different impact on people who have a protected characteristic (age, disability, gender re-assignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex or sexual orientation), in different ways from people who don't have that characteristic. Please provide any evidence that may be useful to assist in assessing policy impacts.

System governance reform will cause the pace towards Net Zero to be accelerated. The system will become more digital, and consumers able to engage with this type of system will realise the benefits of engagement, and other consumers not.

This creates a risk that reform favours those who have the financial and other resources to engage in these changes, and disadvantages those who do not. We recommend this is explored further in the context of the journey to Net Zero as a whole.

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